

### **Remarks**

The telephone interview with Applicants' representatives on November 15, 2005 is hereby acknowledged with great appreciation.

### **Election with Traverse**

The Examiner has required restriction of the claims to one of the following inventions under 35 U.S.C. 121:

- I. Claims 1 – 11, drawn to a supported catalyst, classified in class 502, subclass 164 at seq.
- II. Claims 12 – 29, drawn to a process of converting a hydrocarbon feed stream into C4 and C6 products, classified in class 585, subclass 708.

As discussed with Examiner during the telephone interview on November 15, 2005, as well as in previous response dated June 25, 2005 to Examiner's first office action dated February 22, 2005, Applicants elected, with traverse, claims 1 – 11 of invention I. By Applicants' election of Group I, claims 12-29 of Group II are therefore withdrawn from consideration. However, as acknowledged by the Examiner during the telephone interview on November 15, 2005, upon allowance of catalyst Claims 1-11, applicants respectfully request claims 12-29 to be rejoined (see MPEP § 821.04). Applicants respectfully request reconsideration and withdrawal of the restriction requirement.

### **Rejections**

The Examiner has rejected claims 1- 11 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. Pursuant to the undersigned's understanding of the discussions during the aforementioned telephone interview, Applicants have amended independent Claim 1 per the Examiner's suggestion to replace "consists essentially of" with "consists of" when reciting the genres of halides of elements that the anions may be selected from. Accordingly, Claim 4 has been amended to delete the recitation of the genres of halides of

elements that the anions may be selected from. Support for this amendment can be found on paragraph [0012] of the specification. Applicants therefore submit that the Examiner's rejection of Claims 1-11 under 35 U.S. C. 112 first paragraph is now moot in view of the amendment made.

The Examiner has rejected claims 1 - 11 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. As suggested by Examiner in the Final Office Action, Claim 1 has been amended to delete (IIIA) to avoid the confusion compared to the clearer terminology of using Arabic numerals. Likewise, the Roman numerals in Claims 10 and 11 have also been deleted as suggested by Examiner. In addition, the "and" between "iron" and "phosphorus" in the last line of Claim 1 has been replaced with comma as suggested by Examiner. With regard to the rejection of claim 7, Applicants have amended Claim 1, as agreed to by the Examiner during the aforementioned telephone interview, to add Boron as a separate element from the Group 13 metal elements in the Markush group. The support for this amendment can be found on paragraph [0012] of the specification by the original text from paragraph [0012] that "[M]ore preferably, the anion is selected from the group consisting of chlorides of aluminum, gallium, copper, zinc, and iron; fluorides of phosphorus and **boron**, and combinations thereof." *Emphasis added.* Thus, even though boron is not technically a Group 13 (or IIIA) metal, it is still a Group 13 element and was clearly considered by the Applicants to be included in the choice of terms within the anion Markush group. Applicants therefore submit that the Examiner's rejection of Claims 1-11 under 35 U.S. C. 112 second paragraph is now moot in view of the amendments made and agreement reached during the interview.

With regard to Examiner's note concerning claim 6 and regarding the number of carbon atoms per molecule in the R groups, it was discussed during the aforementioned telephone

interview whether the addition of the term “molecule” after the recitation of “R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>5</sub>, R<sub>6</sub>, and R<sub>7</sub>” and “R<sub>4</sub>, R<sub>8</sub>, R<sub>9</sub>, R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub>, R<sub>13</sub>, R<sub>14</sub>, R<sub>15</sub>, R<sub>16</sub>, R<sub>17</sub>, R<sub>18</sub>, and R<sub>19</sub>”, was necessary to further clarify that the number of carbon atoms per molecule as recited in claim 6 applies to each R molecule rather than to the whole cation structure. Applicants agree with the Examiner’s suggestion, made during the interview, that the addition of the term “molecule” is not necessary.

The Examiner has rejected claims 1 – 5 under 35 U.S.C. 102(b) as being anticipated by Benazzi et al., USP 5,693,585.

As applicants presented in the previous response, as well as mentioned during the aforementioned telephone interview with the Examiner, Benazzi discloses a catalyst which includes a porous organic or mineral support, preferably silica, and at least one active phase containing at least one aluminum halide, at least one amine hydrohalide, preferably an amine hydrochloride or hydrobromide, and/or at least one quaternary ammonium halide, and at least one Cu(I) compound. Benazzi also discloses that the support is impregnated by at least one active phase which is an ionic complex not miscible with the hydrocarbon phase, commonly known as a molten salt. See Bennazi, Col. 2, lines 15 – 24. Benazzi also discloses in Col. 3, lines 64 – 65 that “[a]n essential feature of the invention is the presence of copper (I) in the active phase on the support.” In addition, the organic or mineral support, preferably silica, is generally such that, before impregnation by the acid phase, the specific surface area is in the range 0.1 m<sup>2</sup>/g to 1500 m<sup>2</sup>/g, and its total pore volume is in the range 0.1 cm<sup>3</sup>/g to 6 cm<sup>3</sup>/g. See Bennazi, Col. 4, lines 33 – 36.

Applicants submit that claims 1 – 5, as currently amended, are patentably distinct over Benazzi. Claim 1 has been amended to claim a “catalyst system consisting essentially of an ionic liquid dispersed on a porous support ...”, and such that the “anion consists of halides of elements selected from the group consisting of: Group 13 metals, zinc, iron, phosphorus, boron, and

combinations thereof”, not including copper. As discussed during the interview, Benazzi requires the presence of at least one cuprous compound, which is an essential feature of Benazzi’s invention.

Also, as to paragraph 10 of the Examiner’s final office action, Applicants respectfully disagree with the Examiner’s assumption that the cuprous chloride of Benazzi’s catalyst system is introduced into the catalyst system as a neutral compound. Benazzi discloses that: “An *essential feature* of the invention is the presence of copper (I) in the active phase on the support”. See Benazzi, Col.3, lines 64-65, emphasis added. Applicants thus submit that copper (I) cannot be neutral if it is an “essential” feature of the Benazzi invention possessing a functionality of its own in the active phase on the support. Such functionality has been disclosed by Benazzi in part by the disclosure that “we have unexpectedly discovered that the addition of copper (I) compounds, in particular cuprous halides, to the ionic complexes described in the cited patent application improves the selectivity and stability of the catalyst, preventing the introduction of the additional protons to reactivate the catalyst and reducing the chlorine content of the alkylates which are the reaction products.” See Benazzi, Col. 1, line 65 to Col. 2., line 4. Benazzi also discloses in Table 1 (see Col.7, lines 36-53) the comparative catalytic results obtained from the alkylation tests of isobutane by 2-butene using catalysts with and without the presence of copper (I). Benazzi concluded that Table I demonstrates the effect of the presence of copper (I) in the catalyst, that is, the catalyst including the presence of copper (I) had a higher selectivity for C8 compounds and a lower selectivity for the undesirable heavy C9 compounds as compared to a control catalyst not containing copper (I). Benazzi also concluded the catalyst with the presence of copper (I) led to a smaller chlorine loss than the control catalyst not containing copper (I). (See Col.7 line 35 – 52).

Therefore, applicants submit that the Benazzi reference demonstrates that the inclusion of the copper (I) component of the Benazzi catalyst into the inventive catalyst of the present

invention as claimed in Claim 1, as amended, would not be a mere “neutral” addition to the catalyst system, but would rather be expected to have a material affect on the basic and novel characteristics of the inventive catalyst system of Claim 1. Accordingly, amending Claim 1 as mentioned above to claim “[A] catalyst system consisting essentially of an ionic liquid dispersed on a porous support ...”, excludes the presence of the cuprous chloride (copper (I)) compound of Benazzi in the catalyst system of Claim 1 because the copper (I) compound would be expected to have a material affect on the basic and novel characteristics of the inventive catalyst system of Claim 1. In support of this, Applicants direct the Examiner’s attention to section 2111.03 of the MPEP which states that “[T]he transitional phrase “consisting essentially of” limits the scope of a claim to the specified materials or steps “and those that do not materially affect the basic and novel characteristic(s) of the claimed invention.” See MPEP, May 2004, page 2100-52.

Applicants therefore submit the claim 1, as amended, and claims 4-5 depending therefrom, each distinguish over Benazzi in that Claim 1, as amended, excludes the presence of copper (I) which is required to be present in Benazzi.

Also, as discussed with the Examiner during the aforementioned telephone interview, and in response to the Examiner’s statements in paragraph 10 of the Final Office Action, Applicants submit again that claims 1 – 5 are patentably distinct over Benazzi in that Benazzi does not recognize the importance of having an average pore diameter greater than about 225 angstroms. The Examiner has used a formula from the Furtek et al. USP 5,118,648 to calculate the pore diameter from the pore volume and surface area as given in Benazzi. Based on this formula, and the disclosures in the Benazzi reference, the average pore diameter for the supports disclosed in Benazzi can range from around 2.67 angstroms to about 2,400,000 angstroms. The inventive catalysts of the Benazzi reference prepared in Examples 1, 3 and 7 used different silica supports having average pore diameters, as calculated using the formula from the Furtek patent, of 253, 210, and 38 angstroms, respectively. Thus, the Benazzi patent did not recognize any distinction

between a support having as low as a 38 angstrom average pore diameter up to a support having an average pore diameter of 253 angstroms. Applicants discovered an unexpected sharp rise in isopentane conversion when the silica support average pore diameter is greater than about 225 angstroms.

Once again, the Examiner's attention is drawn to Table II of the specification (on page 7) which shows that the isopentane conversion using control support A, with an average pore diameter of 164 angstroms, resulted in only 30.5 weight percent conversion of isopentane, whereas the isopentane conversion for the inventive runs using supports B1 (372 angstroms), B2 (308 angstroms) and B3 (228 angstroms) resulted in isopentane conversions of 76.0, 72.2 and 53.5 weight percent, respectively. As set out in the MPEP on pages 2100-76 to 2100-77 in section 2131.03 II., "[i]n order to anticipate the claims, the claimed subject matter must be disclosed in the reference with "sufficient specificity to constitute an anticipation under the statute." Such section also states that, with evidence of unexpected results, the claimed narrow range may be found to have not been disclosed with "sufficient specificity" to constitute an anticipation of the claims by a reference which teaches a broad range. Again, as Applicants discussed with the Examiner during the aforementioned telephone interview, the limitation that the average pore diameter is greater than about 225 angstroms represents a sufficiently narrow range, and, coupled with the clear evidence of unexpected results for use of a support including this average pore diameter range of greater than about 225 angstroms, Applicants submit that such evidence reasonably supports the conclusion that this narrow range is not disclosed with "sufficient specificity" to constitute anticipation of the claims by the Benazzi reference, which again, did not recognize any distinction between a support having as low as a 38 angstrom average pore diameter (in example 1) up to a support having an average pore diameter of 210 (in example 3) and 253 (in example 7) angstroms.

The Examiner has again rejected claims 1 – 9 under 35 U.S.C 103(a) as being unpatentable over Benazzi as cited above. Applicants submit that the arguments set out above regarding the rejection of claims 1 – 5 based on 35 U.S.C. 102(b) apply equally to this rejection under 35 U.S.C. 103(a). In particular, Applicants submit that claims 1 – 9, as amended, are patentably distinguishable over the Benazzi reference.

The Examiner has again rejected claims 1 – 11 under 35 U.S.C. 103(a) as being unpatentable over Benazzi in view of Welton, Chem. Rev. 1999, Vol. 99, pp. 2071-2083.

As applicants previously presented, Welton discloses the use of a rhodium compound with an ionic liquid for use in hydrogenation reactions, for example, the hydrogenation of pent-1-ene and cyclohexene. The Benazzi reference, on the other hand, is directed to the use of its ionic liquid catalyst for the alkylation of hydrocarbons. Thus, Applicants submit that one of ordinary skill in the art would likely suspect that the addition of the rhodium (Group III) metal to the catalyst of the Benazzi reference could frustrate the alkylation reaction by possibly causing hydrogenation of the olefins in the feedstream. At a minimum, it is not at all clear that one of ordinary skill in the art would be motivated, upon reading the Benazzi reference, to seek out the addition of a Group VIII metal as disclosed by Welton for use in hydrogenation reactions, in order to enhance the alkylation activity of its catalyst. In fact, it appears that the Benazzi reference teaches away from the addition of rhodium from Welton into its catalyst because incorporating rhodium would be expected, from the teachings of Welton, to result in hydrogenation of the olefins Benazzi is attempting to alkylate. Therefore, it appears to the applicant that the Examiner has not shown proper, if any, motivation within Benazzi to seek out the Welton reference for incorporation of a Group VIII metal into the Benazzi catalyst. Again, Applicants respectfully request reconsideration and withdrawal of this rejection.

### **Status of Claims**

Claims 1, 4, 10 and 11 have been amended.

Claims 12-29 remain withdrawn.

Claims 1-11 are currently pending.

No new matter was added by way of amendments of original and previously amended claims.

### **Amendments to the Specification**

Paragraph [0012] has been amended to recite Boron, separately from Group 13 metals, as a member of the Markush group which is supported by the original text in paragraph [0012] which states that “[M]ore preferably, the anion is selected from the group consisting of chlorides of aluminum, gallium, copper, zinc, and iron; fluorides of phosphorus and **boron**, and combinations thereof.” Thus, even though boron is not technically a Group 13 (or IIIA) metal, it is still a Group 13 element and was clearly considered by the Applicants to be included in the choice of terms within the anion Markush group.

No new matter was added by way of amendment to Paragraph [0012] of the originally filed specification.



**Conclusion**

In view of the amendments to claims 1, 4, 10 and 11, and the remarks above, claims 1 – 11 are now believed to be in condition for allowance. Therefore early allowance for claims 1 – 11 is respectfully requested.

Should any fees have been inadvertently omitted, or if any additional fees are required or have been overpaid, please appropriately charge or credit those fees to Deposit Account Number 16-1575 of ConocoPhillips Company., Houston, Texas, and consider this a petition for any necessary extension of time.

Respectfully submitted,

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<p style="text-align: center;"><b>CERTIFICATE OF MAILING</b></p> <p>I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Alexandria, VA 22313-1450, on</p> <p style="text-align: center;"><u>December 14, 2005</u> (Date)</p> <p style="text-align: center;"><u>Jeffrey R. Anderson</u> Jeffrey R. Anderson</p>
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